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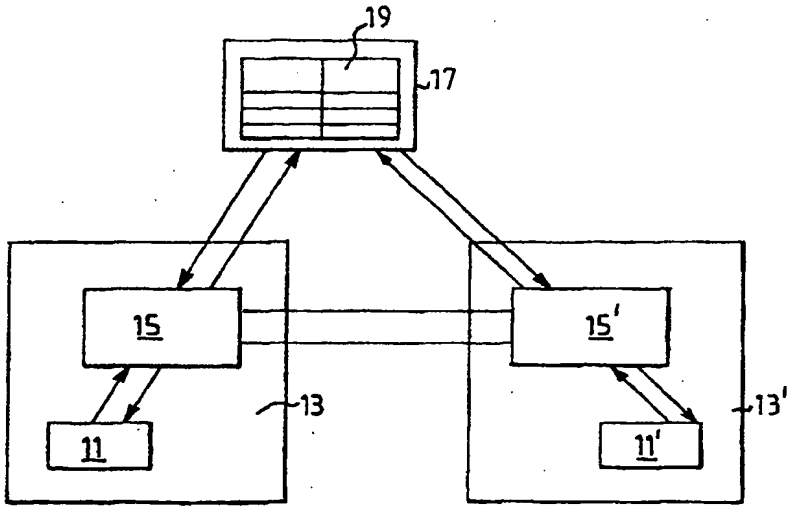

(57) Abstract

The present invention relates to a method and an apparatus for establishing connections between tow subscribers in an Internet Protocol (IP) based network, said network being divided into zones, or subnetworks, each zone being managed by a gatekeeper (15, 15'; 25, 25'). All gatekeepers are connected to a zone management means (17; 27), which holds information about the logical addresses of all user terminals (11, 11'). A first user (11) in a first zone (13) managed by a first gatekeeper, who wishes to establish a connection to another user (11') in another zone (13') managed by a second gatekeeper (15') sends a request to the first gatekeeper (15), from which the request is forwarded to the zone management means (17). The zone management means (17) requests the address from the second gatekeeper (15') and returns an address confirmation, so that the connection may be set up.

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METHOD AND DEVICE FOR ESTABLISHING CONNECTIONS BETWEEN TWO SUBSCRIBERS IN TWO DIFFERENT SUBNETWORKS

Technical Field

The present invention relates to the communication between terminals in Internet Protocol (IP) based networks.

Background

The Internet is being used to an increasing degree for commercial communication. In particular there is a demand for real-time applications for voice, image and data in decentralized corporate data networks.

With present technology, companies may connect several Intranets and remote users in an Internet Virtual Private Network (VPN).

A Virtual Private Network (VPN) may comprise a number of zones, or subnetworks. For example each department in a company may have its own zone, all zones being connected to one large network. Each zone has its own gatekeeper, which holds information about all addresses in its own zone.

There are known solutions for letting end users in a network communicate by means of a gatekeeper within a zone or via a location service, but direct communication between the different gatekeepers is not handled today.

Summary of the Invention

It is an object of the present invention to provide a Virtual Private Network (VPN) with internal zones, in which direct communication between the different zones is enabled.

It is another object of the invention to enable the roaming between different zones in a VPN.

These objects are achieved according to the invention by a zone management means, which is connected to the gatekeepers of all the zones in the VPI.

The zone management means holds information about all addresses found in gatekeepers in the VPN and assists in the address resolution within a VPN.

The solution according to the invention offers the following advantages:
- Roaming in the network is supported, that is, users are enabled to move between different terminals and different zones in the network.
- A private network for audio, video and/or data communication is created, which comprises internal zones and which can cooperate with external clients and location services.
- The network according to the invention promotes distribution of functionality with respect to TCP/IP.

Brief Description of the Drawings

Figure 1 shows a connection between two end users in a zone, assisted by a gatekeeper, according to prior art;
Figure 2 shows a connection between two end users in different zones, assisted by gatekeepers and a zone management means, according to the invention;
Figure 3 shows the signalling that takes place when a connection between two end users in different zones is set up, according to the invention;
Figures 4A and 4B show the signalling that takes place when a new gatekeeper is to be registered and unregistered, respectively, with the zone management means;
Figures 5A and 5B show the signalling that takes place when a new endpoint is to be registered, respectively, with the zone management means; and
Figure 6 illustrates the principles for roaming in the network according to the invention.

Detailed Description of Embodiments

Figure 1 is a schematic drawing of a connection between two end users 1 in a zone 3 of a private network, assisted by a gatekeeper 5, as common in the art. The gatekeeper 5 holds information about the location of all addresses belonging to its zone, and also sets up connections within the zone.

The solution according to the invention may be implemented in any kind of data network. For simplicity, a protocol known as H.323, which is a de facto standard in audio, video and/or data communication, will be used as a basis for the discussion.

Figure 2 is a schematic drawing of a network according to the invention. The network is divided into different zones 13, 13', each zone comprising a gatekeeper 15, 16'. Each end user 11, 11' is connected the gatekeeper 15, 15' of the zone 13, 13' to which it belongs. All gatekeepers are connected to one zone management means 17, according to the invention. The zone management means 17 comprises a table 19 of the logical addresses, or alias addresses, of all registered end points in all zones of the network, and the zone in which each end point is registered.

An end user 11 who wishes to establish a connection to another end user 11' in a different zone, initiates this by signalling to the gatekeeper 15. The gatekeeper 15 requests the destination from the zone management means 15. The zone management means 17 informs the gatekeeper 15 of the physical location of the end user 11' to which the connection is to be set up. The signalling between the gatekeepers 15, 15' of the two networks then proceeds in the way common in the art.

If the H.323 protocol is used, the signalling that takes place will be as shown in more detail in Figures 3, 4A, 4B, 5A and 5B.

Figure 3 shows the signalling that takes place when an end user 11 in one zone 13 wishes to set up a connection to another end user 11' in a different zone 13'.

The end user 11 who wants to set up a connection to another end user 11', sends an Address Request (ARQ) signal to its gatekeeper 15. The ARQ signal comprises the following:

- the destination alias address (the address of the receiving end user 11')
- the Destination Call Signalling Address (normally the address of the receiving end user 11')
- the Source Alias Address (the address of the end user 11 initiating the connection)
- the Source Call Signalling Address (normally the address of the end user 11 initiating the connection)
- the desired bandwidth
- The desired Call Model

The gatekeeper 15 sends a Zone Request (Zone RQ) signal comprising the Destination Alias Address of the receiving end user 11' to the zone management means 17.

The zone management means 17 responds by sending a Zone Confirmation (Zone CF) signal to the gatekeeper 15, comprising the message DestinationOkWellKnownRasAddress, which indicates that the address has been located. (RAS Address = Registration Admission and Status Address)

The gatekeeper 15 can then send a Location Request (Location RQ) signal to the gatekeeper 15' of the zone to which the receiving end user 11' belongs.

The gatekeeper 15' responds by sending a Location Confirmation (Location CF) signal to the gatekeeper 15, comprising the Destination Call Signalling Address

The gatekeeper 15 responds to the end user 11 with an Address Confirmation (ACF) signal comprising the following information:

- the bandwidth available/allocated

- the call model to be used
- the destination call signalling address

The end user 11 then sends a Setup signal to the gatekeeper 15 comprising the following information
- bearer capability
- user to user information

The gatekeeper forwards the information in the setup signal to the receiving end user 11'.

The receiving end user 11' sends an Address Request (ARQ) signal to its gatekeeper 15', comprising the following information:
- the destination alias address
- the Destination Call Signalling Address
- the Source Alias Address
- the Source Call Signalling Address
- the desired bandwidth
- The desired Call Model

The gatekeeper 15' responds by sending an Address Confirmation (ACF) signal to the end user 11', comprising the following information
- Bandwidth
- Call Model
- Destination Call Signalling Address

The receiving end user 11' then sends a Connect signal to the gatekeeper 15 in the zone of the sending end user 11, comprising the following information:
- Transport Address H.245 Control Channel
- Destination endpoint Type

The gatekeeper 15 forwards the Connect signal to the end user 11.

Figure 4A shows the signalling that takes place between a gatekeeper 15, 15' and a zone management means 17 when a new gatekeeper is to be registered with the zone management means 17, if the H.323 protocol is used. The gatekeeper 15, 15' sends a Gatekeeper Registration Request , GK_RRQ, comprising the GatekeeperWellKnownRasAddress, which is the address by which the Gatekeeper 15, 15' is known in the network, to the zone management means 17. The zone management means 17 responds with a Gatekeeper Registration Confirmation, GK_RCF, signal comprising the ZoneIdentifier, which is the identification to be used for the zone of the new gatekeeper, to confirm that the gatekeeper has been registered as a gatekeeper for this zone.

Figure 4B shows the signalling that takes place between a gatekeeper 15 and a zone management means 17 when an existing gatekeeper 15 is to be unregistered, that is deleted from the domain of the zone management means 17. Again the H.323 protocol is assumed. The gatekeeper 15 sends a Gatekeeper Unregistration Request, GK_URQ, to the zone management means 17, comprising the ZoneIdentifier. The zone management means 17 responds by sending a Gatekeeper Unregistration Confirmation, GK_UCF, signal back to the gatekeeper 15, comprising the NumberOfEndPointsUnregistered, which indicates how many end points are connected to the gatekeeper 15 that has been unregistered. The GK_UCF signal confirms that the gatekeeper 15, is no longer registered with the zone management means 17.

Figure 5A shows the signalling that takes place between and endpoint, that is a user terminal 11, and a gatekeeper 15, and between a gatekeeper 15 and a zone management means 17, when a new endpoint 11 is to be registered, according to H.323 protocol. First the new endpoint 11 sends a Registration Request, RRQ, signal to its gatekeeper 15, comprising the following:

- CallSignallingAddress - The address of the gatekeeper 15
- RAS_Address - Registration Admission and Status Address
- TerminalType - The type of terminal connected at the end point 11
- AliasAddress - The address by which the new end point 11 will be known in the network

The gatekeeper 15 sends an End Point Registration Request, EP_RRQ, signal to the zone management means 17, comprising the following:
- EndPointIdentifier - identifying the new end point 11
- ZoneIdentifier - identifying the zone in which the new end point is found
- AliasAddress - the address by which the new end point will be known in the network

The zone management means 17 responds to the gatekeeper 15 by sending an End Point Registration Confirmation, EP_RCF, signal, comprising the AliasAddress of the new end point 11.
The gatekeeper 15 then responds to the new end point 11 with a Registration Confirmation, RCF, signal comprising the following:
- GK_CallSignalAddress - the address of the gatekeeper
- EndPointIdentifier - the identifier of the new end point 11

The new end point 11 has now been registered with the gatekeeper 15 and the zone management means 17.

Figure 5B shows the signalling that takes place when an existing endpoint 11 is to be unregistered, that is, now longer to be connected to the gatekeeper 15.
First the new endpoint 11 sends a Unregistration Request, URQ, signal to its gatekeeper 15, comprising the following:
- CallSignallingAddress - the address of the gatekeeper 15
- EndPointIdentifier - the identifier of the end point 11 to be unregistered
- AliasAddress - the address by which the end point 11 is known in the network

The gatekeeper 15 sends an End Point Unregistration Request, EP_URQ, signal to the zone management means 17, comprising the following:
- EndPointIdentifier - identifying the new end point 11
- ZoneIdentifier - identifying the zone 13 in which the new end point 11 is found
- AliasAddress - the address by which the end point 11 is known in the network

The zone management means 17 responds to the gatekeeper 15 by sending an End Point Unregistration Confirmation, EP_UCF, signal, comprising the AliasAddress of the end point 11.
The gatekeeper 15 then responds to the new end point 11 with an Unregistration Confirmation, UCF, signal.
The new end point 11 has now been unregistered from the gatekeeper 15 and the zone management means 17.

Figure 6 illustrates the principles for roaming in the network according to the invention, that is, for a person or a terminal to move between zones. A number of end points, 21a, 21b, 21c in a first zone 23 are connected to a first gatekeeper 25. Other end points 21d, 21e in a second zone 13' are connected to a second gatekeeper 25'. Both gatekeepers 25, 25' are connected to a zone management means 27.

Each gatekeeper 25, 25' is also connected to a database means 29 and 29' respectively. The database means 29, 29' comprise records of information about the services assigned to each end point 21a,... 21e in the zone 23, 23' to which the database means 29, 29' belongs. Examples of services may be a wake-up call, or the supplementary services as specified in the H.323, such as call redirection. The services are executed in execution means 31 and 31' respectively.

For roaming to be possible, the logical addresses of all end points or users 21a,...21e - must be unique in the whole network. The most convenient way of assuring this is to include the name of the zone to which the user belongs in the name. In this example

this would mean that a user 21a in the first zone 23 would be identified by its number (or logical name) together with the number (or logical name) of the zone, for example 23.21a or another well-defined format. The user might keep this name even when he moved to another zone, or the zone name might be changed.

A user 21a who wishes to move from one zone 23 to another 23', registers with the gatekeeper 25' in the new zone 23'. The gatekeeper 25' then informs the zone management means 27 that the subscriber is now found in the zone 23' of this gatekeeper 25'. The signalling is performed according to Figure 5A. In one embodiment of the invention, the user 21a must disconnect from the first gatekeeper 25, as shown in Figure 5B, before connecting to the new gatekeeper 25'. In another embodiment the zone management means automatically deletes the user 21a from the first gatekeeper 25.

The services assigned to the user 21a are stored in the database means 29 connected to the first gatekeeper 25. When the user 21a moves to a different zone, the service records belonging to that user 21a may be moved to the database means 29' connected to the new gatekeeper 25'.When a service is activated, it will then be executed in the execution means 31' of this zone 23'. It would also be possible to keep the service records in the first database 29. In that case, the execution of the service would be carried out in the execution means 31 of the first zone 23.

Moving within one zone may be done in the same way, except that no changes are needed to the services.

CLAIMS

1. An apparatus (17) for enabling connections between a transmitting (11) and a receiving (11') user terminal, each one of said terminals (11, 11') being located in an audio, video and/or data communication network, said networks forming zones (13, 13') in a larger data communication network, each zone (13, 13') being managed by a gatekeeper (15, 15'), said apparatus being connected to the gatekeepers of at least two zones (13, 13') in the network,
characterized in that it comprises:
- connections to the gatekeepers (15, 15') of all zones (13, 13') in the network
- information about the logical addresses of user terminals (11, 11') found in the different zones (13, 13').

2. An apparatus according to claim 1, **characterized** in that a subscriber connected to one gatekeeper (15) may register temporarily with another gatekeeper (15').

3. An apparatus according to claim 1 or 2, **characterized** in that it is adapted for H.323 protocol signalling.

4. A method for establishing a connection between a sending user terminal (11) and a receiving user terminal (11') each one of said terminals (11, 11') being located in an audio, video and/or data communication network, said networks forming zones (13, 13') of a larger data communication network, each zone (13, 13') being managed by a gatekeeper (15, 15')
characterized by the following steps:
- Sending a signal from a first user terminal (11) in a first zone (13) to the gatekeeper (15) of that zone (13), requesting an address for a second user terminal (11') in a second zone (13');

- Requesting information about the second zone (13') in which the second user terminal (11') is found, and the gatekeeper (15') of this zone (13'), from an apparatus (17) comprising information about all user terminals (11, 11');
- Locating the second user terminal (11') in the second zone (13');
- Disconnecting the connection to the zone management means (17);
- Establishing the connection between the first (11) and the second (11') user terminal.

5. A method according to claim 4, **characterized** in that the signal sent from the first user terminal is an address request signal according to H.323 protocol.

6. A method according to claim 4 or 5, **characterized** in that the identification of the second zone (13') is carried out in the following steps:
- Sending a zone request signal from the gatekeeper (15) to the zone management means (17);
- Sending a location request signal from the zone management means (17) to the gatekeeper (15') in the zone of the receiving user terminal (11');
- Sending a location confirmation signal from the gatekeeper (15') to the zone management means (17);
- Sending an address confirmation signal from the zone management means (17) to the gatekeeper (15).

7. A method according to any one of claims 4, 5 or 6, **characterized** in that the second user terminal (11') in the second zone (13') is located, and the connection between the first (11) and the second (11') user terminal is set up, in the following steps:
- Sending a setup signal from the sending end user (11) to the gatekeeper (15), specifying the bearer capability;
- Sending the information in the setup signal from the gatekeeper (15) to the receiving end user (11');

- Sending an address request signal from the receiving end user (11') to its gate-keeper (15');
- Sending an address confirmation signal from the gatekeeper (15') to the end user (11') ;
- Sending a connect signal from the receiving end user (11') to the gatekeeper of the sending end user (11);
- Forwarding the connect signal from the gatekeeper (15) to the sending end user (11');

8. A network for audio, video and/or data communication **characterized** in that it comprises a number of subnetworks, or zones (13, 13'), each zone managed by a gatekeeper (15, 15'), and all gatekeepers connected to a zone management means (17) according to any one of claims 1-3.

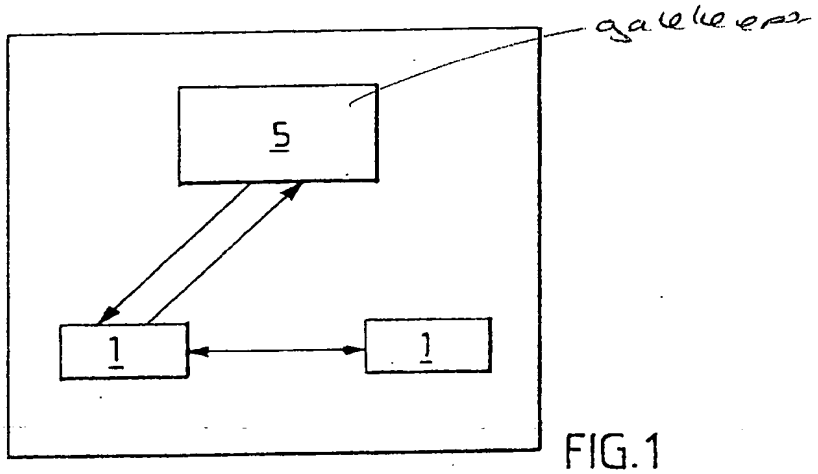

FIG. 1

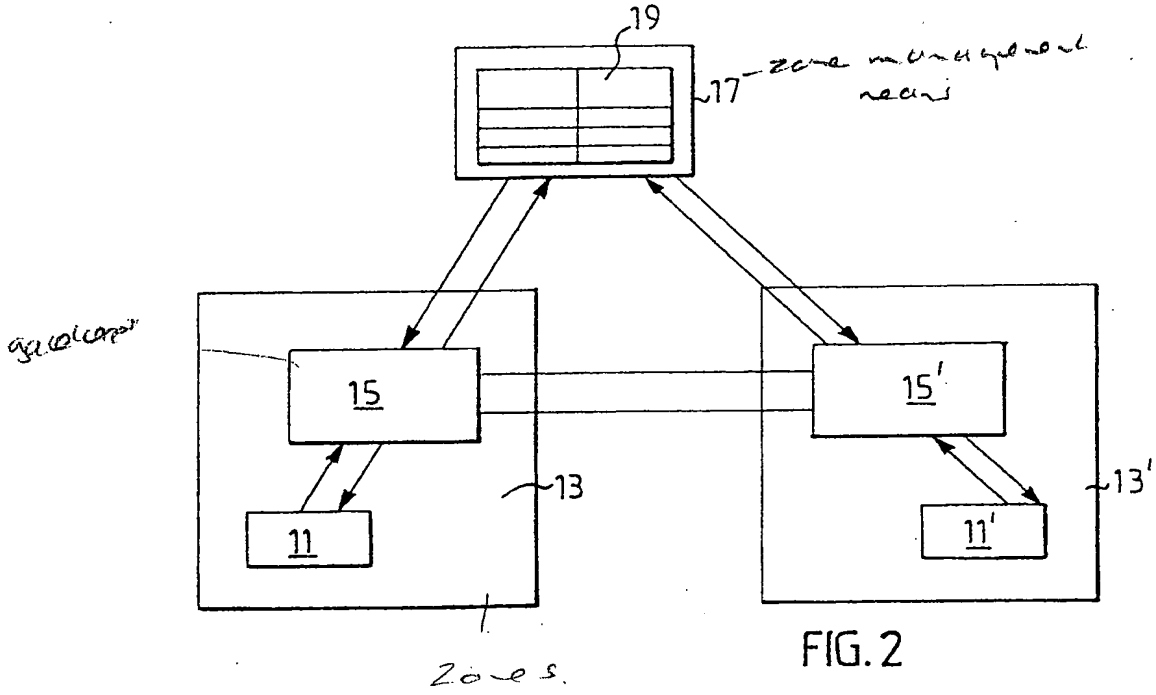

FIG. 2

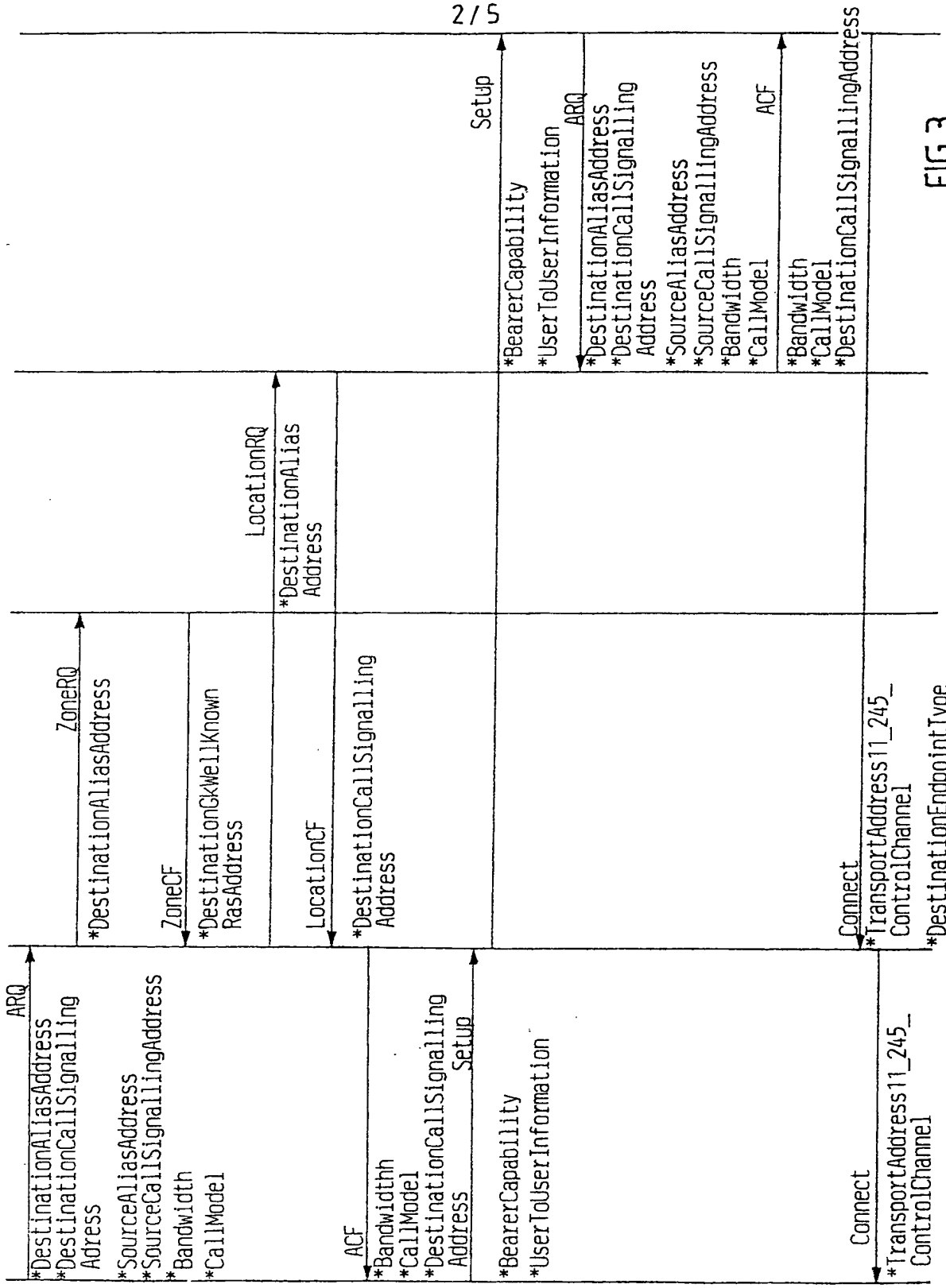
ARQ
*DestinationAliasAddress
*DestinationCallSignalling Adress
*SourceAliasAddress
*SourceCallSignallingAddress
*Bandwidth
*CallModel
ZoneRQ
*DestinationAliasAddress
ZoneCF
*DestinationGkWellKnown RasAddress
LocationRQ
*DestinationAlias Address
LocationCF
*DestinationCallSignalling Address
ACF
*Bandwidthh
*CallModel
*DestinationCallSignalling Address
Setup
*BearerCapability
*UserToUserInformation
Setup
*BearerCapability
*UserToUserInformation
ARQ
*DestinationAliasAddress
*DestinationCallSignalling Address
*SourceAliasAddress
*SourceCallSignallingAddress
*Bandwidth
*CallModel
ACF
*Bandwidth
*CallModel
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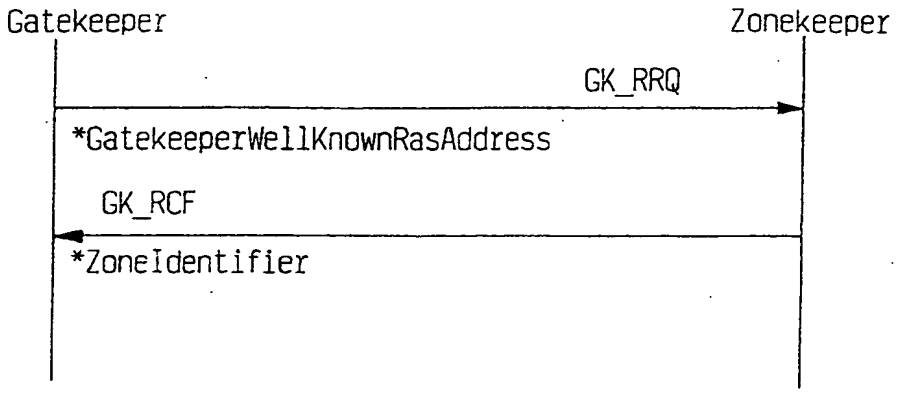
FIG.3


Gatekeeper
Zonekeeper
GK_RRQ
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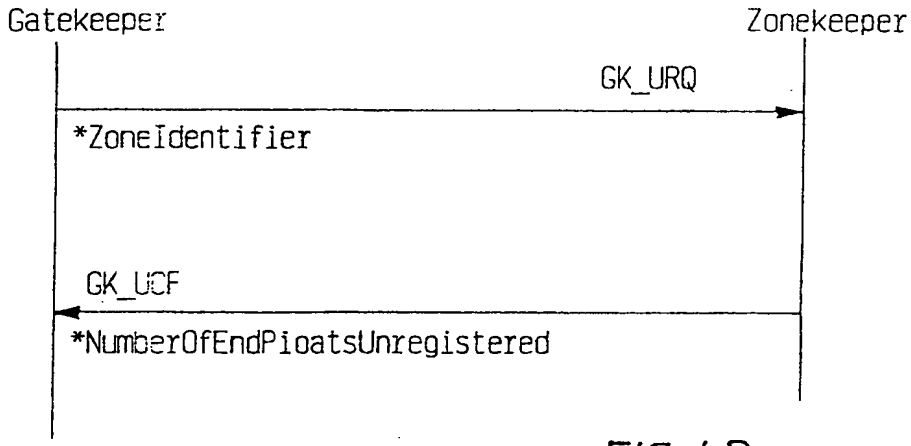
GK_RCF
*ZoneIdentifier

FIG.4A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Zonekeeper
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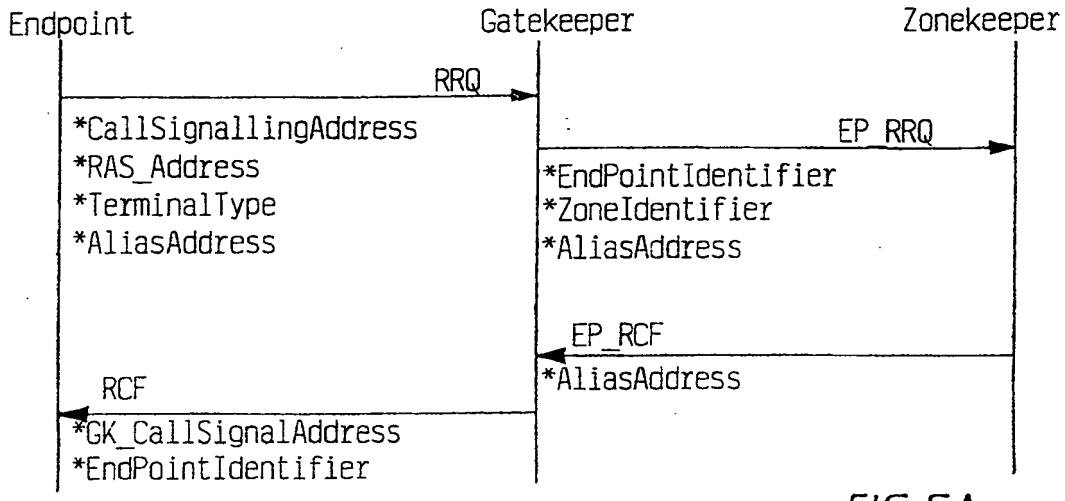
FIG.4B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Zonekeeper
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*RAS_Address
*TerminalType
*AliasAddress
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*ZoneIdentifier
*AliasAddress
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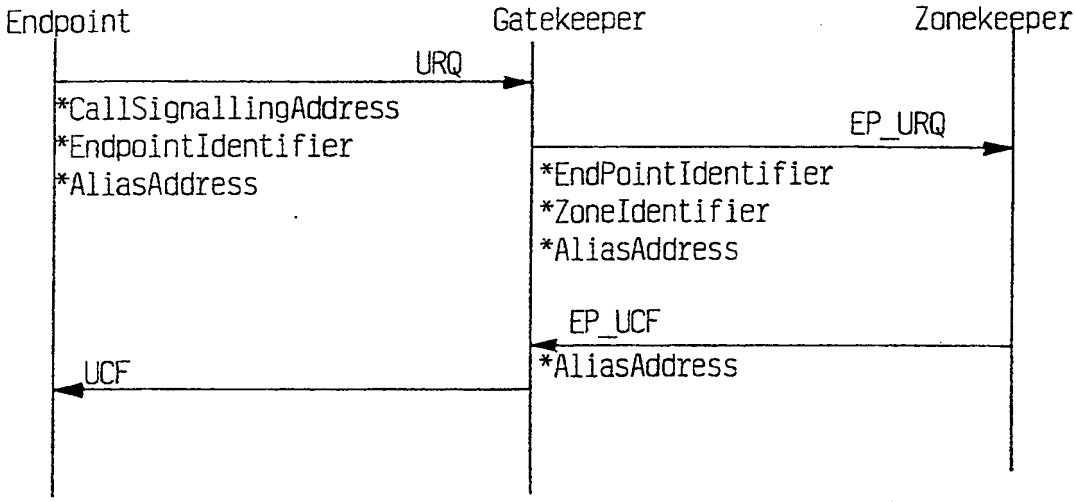
*AliasAddress
RCF
*GK_CallSignalAddress
*EndPointIdentifier

FIG.5A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Zonekeeper
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EP_URQ
*EndPointIdentifier
*ZoneIdentifier
*AliasAddress
EP_UCF
*AliasAddress
UCF

FIG.5B

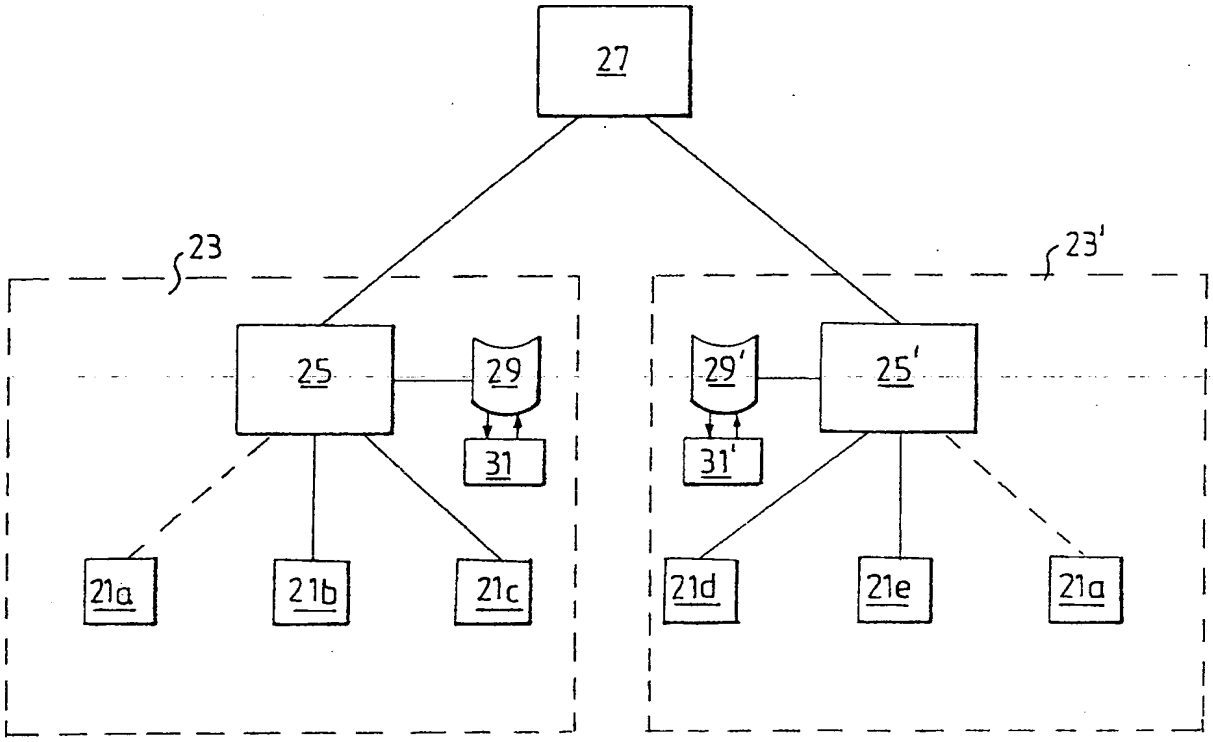

FIG.6